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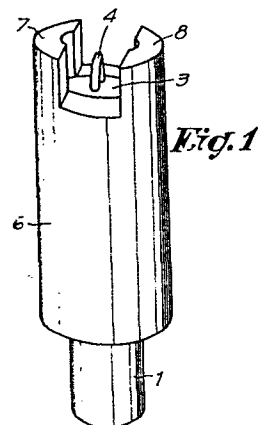
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(54) **Immersion measuring probe for use in liquid metals.**

(57) Immersion measuring probe for use in liquid metals of the type consisting of a measuring head (2) carrying at least one measuring element (4) and being fixed to an extremity of a tube (1) which is intended for being slid onto a supporting lance, characterized in that the probe shows at least one projection (7, 8, 9) made of a heat-resistant material which at the side to be immersed reaches farther than the measuring element (4), the said material having a density not exceeding about 2.5 g/cm³.



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"Immersion measuring probe for use in liquid metals".

This invention relates to immersion measuring probes for use in liquid metals.

For measuring e.g. the temperature and/or oxygen content of
5 a liquid metal mostly immersion probes are used which
traditionally consist of a tube whose extremity to be
immersed is sealed by a stopper-shaped measuring head
carrying one or more measuring elements as well as a corres-
ponding numbers of connectors. The measuring elements
10 protrude from the measuring head at the side of the latter
to be immersed and the connectors retrude at the other
side.

Upon use such a measuring probe is slid over a supporting
15 lance whereby a connector takes contact with a contact
block provided for that purpose in the lance. Said contact
block is connected to a measuring instrument through elec-
tric conductors running through the lance.

20 The protruding parts of the measuring elements are usually
protected by metal caps mounted on the measuring heads,
which camps melt away upon immersion in the liquid metal.

Said tubes are mostly made of cardboard. Sometimes they are
25 provided with an insulating protective sleeve in order to
prevent splashing and vibrations on immersion.

Measuring probes as described above are only suitable for single use mainly because metal particles adhere to the measuring elements when the probes are withdrawn from the liquid metal after the first measurement whereby a second
5 measurement becomes impossible.

The main object of the invention is to avoid this drawback and thus to allow several measurements with one and the same immersion probe.

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Another object of the invention is the simplification in many cases of the manufacture of the immersion probe or in lowering the costprice of it.

15 Therefore, an immersion measuring probe is proposed of the type described above, wherein according to the present invention the probe shows at least one projection made of a heat-resistant material, which at the side to be immersed reaches farther than the measuring element, said material
20 having a density not exceeding about 2.5 g/cm³.

In contradiction with the generally accepted view that the measuring element indeed has to be the extreme part of the probe in order to expose it optimally to the liquid metal,
25 it has been found that the extension(s) or projection(s) of a probe according to the present invention have absolutely no deleterious effect on the measurement and that no metal or slag adhered to the measuring element when the probe was withdrawn from the bath.

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The invention is now described more in detail by means of the accompanying drawings wherein :

Figure 1 is a perspective view of an embodiment of a
35 measuring probe according to the invention;
Figure 2 represents the upper part of the probe according to Figure 1 in axial section;

Figure 3 is a perspective view of a second embodiment;
Figure 4 represents a variant similar to that of
Figure 2 and
Figure 5 is a perspective view of a third variant.

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The measuring probe according to Figures 1 and 2 consists of a card-board tube 1, suited for being slid over a supporting lance (not shown) and at one side is provided with a measuring head 2. This measuring head 2 is in the form of a stopper and seals the card-board tube 1. At the side to be immersed in the metal bath it is insulated by a layer 3 of a well insulating refractory material such as refractory cement or ceramic fibres. At the side turned away from tube 1 the measuring head 2 contains the measuring element being in this case a thermocouple 4, whereas at the other side it is provided with a connector 5.

The side of the measuring probe to be immersed is enveloped by an insulating sleeve 6 made of a ceramic fibre such as aluminium oxide, aluminium silicate, zirconium oxide, quartz, etc. which has a wall thickness of about 10 mm ($\pm 20\%$).

The wall of sleeve 6 extends itself at the place of the measuring element by two symmetrically placed projections 7 and 8, which reach e.g. 0.5 cm farther than the small U-shaped thermocouple tube.

In the embodiment according to Figure 3 the whole wall of sleeve 6 extends to a dome-shaped extremity 9 wherein two windows 10 and 11 are cut out.

Finally, in the variant of Figure 4 sleeve 6 is provided with a partition 12 with central opening 13 through which the measuring element protrudes. A complete sealing is achieved by means of a small amount of refractory cement 14.

The presence of partition 12 results therein that the measuring head is still better insulated and that the so-called cold weldings will thus be heated less.

- 5 In the embodiment according to Figure 5 the projections 7 and 8 formed by two small plates made of a heat-resistant material of low density are directly carried by the measuring head 2 wherein they are partly embedded.
- 10 The heat-resistant material chosen for the projections and/or the sleeve according to the invention should have a density not exceeding about 2.5 g/cm³. Experimentally it has been found that if the density is larger than this value the projections have too large a cooling action on
- 15 the liquid metal surrounding the measuring element.

On the other hand the distance between projection and measuring element measured in a direction perpendicular to the axis of the probe should not exceed about 2.5 cm in order

20 to be sure to avoid any adhesion of metal to the measuring element.

The immersion measuring probe according to the invention have still other advantages:

- 25
- the projections or projecting parts of the sleeves protect the measuring elements from mechanical damage during transport and immersion so that the usual protective caps of metal and/or card-board become superfluous;
- 30
- upon immersion in a shallow metal bath the measuring element cannot strike the bottom which would result in a faulty measurement or even in a rupture.
- 35 It is clear that the invention is not limited to the described embodiments and that the latter can be modified without departing from the scope of the invention.

Claims

- 1.- Immersion measuring probe for use in liquid metals of the type consisting of a measuring head (2) carrying at least one measuring element (4) and being fixed to an extremity of a tube (1) which is intended for being slid onto a supporting lance, characterized thereby that the probe shows at least one projection (7, 8, 9) made of a heat-resistant material which at the side to be immersed reaches farther than the measuring element (4), the said material having a density not exceeding about 2.5 g/cm³.
- 2.- Immersion measuring probe according to claim 1, characterized in that the distance between projection (7, 8, 9) and measuring element (4) in a direction perpendicular to the axis of the probe is not larger than about 2.5 cm.
- 3.- Immersion measuring probe according to claim 1, characterized in that the projection (7, 8, 9) is carried by the said measuring head (2).
- 4.- Immersion measuring probe according to claim 1, characterized in that the projection (7, 8, 9) is formed by an extension of the wall either of a protective sleeve (6) enveloping the said tube (1) in a known way, or of the tube (1) itself.
- 5.- Immersion measuring probe according to claim 4, characterized in that the wall has two local extensions (7, 8) which are placed symmetrical with respect to the axis of the sleeve (6) or tube (1).
- 6.- Immersion measuring probe according to claim 4, characterized in that the whole wall extends to a dome-shaped extremity (9) of the sleeve (6) or tube (1) wherein at least two windows (10, 11) are cut out.

7.- Immersion measuring probe according to claim 4, characterized in that the sleeve (6) or tube (1) at the place of the base of the extension shows a partition (12) with a central opening (13) therein through which the measuring
5 element (4) is protruding.

8.- Immersion measuring probe according to claim 1, characterized in that said heat-resistant material consists mainly of kaolin fibres.

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9.- Immersion measuring probe according to claim 1, characterized in that the thickness of the projection (7, 8, 9) in a direction perpendicular to the axis of the probe amounts to about 10 mm.

